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CLAIMS

[Utility model registration claim]

[Claim 1] In the cold cathode tube lighting device which is equipped with the DC-DC conversion circuit which carries out chopping control of the DC-power-supply electrical potential difference, carries out DC-AC conversion of the output voltage of this DC-DC conversion circuit, and drives a cold cathode tube by the switching element A load current detection means to output the load current detection electrical potential difference which detected the load current of a cold cathode tube and is proportional to this load current, The 1st comparator which can adjust with a modulated light means, compares with said load current detection electrical potential difference the load current reference value which it comes to set up as comparison reference voltage to said load current detection electrical potential difference, and outputs a mutual deflection signal, An electrical-potential-difference detection means to output the electrical-potential-difference detection electrical potential difference which detected the output voltage of said DC-DC conversion circuit, and is proportional to this output voltage, Had the 2nd comparator which is made to superimpose a predetermined electrical potential difference on the output signal of said 1st comparator, compares with said electrical-potential-difference detection electrical potential difference the load electrical-potential-difference reference value which it comes to generate as comparison reference voltage to said electrical-potential-difference detection electrical potential difference, and outputs a mutual deflection signal to said switching element as a negative-feedback-control signal. The cold cathode tube lighting device characterized by things.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed explanation of a design]

[0001]

[Industrial Application]

Especially this design is related with the cold cathode tube lighting device for stabilizing the luminous intensity of a cold cathode tube about a cold cathode tube lighting device.

[0002]

[Description of the Prior Art]

It is possible to use the switching power supply circuit known for the part number FA 7612 as this conventional kind of a cold cathode tube lighting device. **Drawing 2** is the circuit diagram showing the example of 1 configuration of the cold cathode tube lighting device which used the circuit of a part number FA 7612.

[0003]

For DC power supply and 2, as for an inverter circuit and 4, in this drawing, a DC-DC conversion circuit and 3 are [1 / a modulated light circuit and 5] cold cathode tubes.

[0004]

The DC-DC conversion circuit 2 consists of switching power supply circuit 24 grade which is marketed by the part number FA 7612 and carries out switching control of the transistor 21 to the transistor 21 of the PNP mold as a switching element which outputs a chopping voltage signal, diode 22, and the choke coil 23 that carries out smooth [of this chopping voltage signal] based on the accommodation electrical potential difference of the modulated light circuit 4.

[0005]

REF is the reference voltage section which is making the direct-current constant voltage power supply of this power circuit 24, receives the electrical potential difference of DC power supply 1, and is the reference voltage VREF of that output. It stabilizes. C1 It is the capacitor which carries out smooth [of the electrical potential difference of DC power supply 1]. OSC is the oscillator section and generates the sawtooth wave of predetermined frequency continuously. ER.AMP is error amplifier, carries out reversal magnification and outputs the part electrical potential difference Vi2 of the load current detection electrical potential difference VS 2 which carries out a postscript. PWM is a PWM comparator and the level of these correspondences outputs H level signal for the level of the lower one of current regulator circuit C.C which carries out a postscript to the output level of error amplifier ER.AMP rather than the level of the oscillator section OSC as compared with the output level of the oscillator section OSC at the adult time. It is the output selection gate, G passes the output-control signal which usually consists of an output of error amplifier ER.AMP, and when having received the inhibiting signal OFF which carries out a postscript, it forbids passage of this output-control signal. CS the capacitor and C.C which are charged for a soft start and short circuit protection -- this capacitor CS the current regulator circuit which supplies the charging current -- it is -- capacitor CS Ranging from starting to a steady state, the charging current is received from current regulator circuit C.C, or resistance RC 1 is minded, and it is reference voltage VREF. Popularity is won. The part electrical

potential difference which comes to pressure this electrical potential difference partially by resistance RC1 and RC2 charges, and he is trying for an electrical potential difference sufficiently higher than this part electrical potential difference to charge in response to the charging current from current regulator circuit C.C at the time of short circuit generating. SCP is a comparator for shunt detection, and if the output level of error amplifier ER.AMP reaches predetermined abnormality level, it will operate current regulator circuit C.C. In addition, LO is a comparator for short circuit protection, and is Capacitor CS. If the charge electrical potential difference VCS reaches the predetermined potential corresponding to a short circuit, an inhibiting signal OFF will be given to the output selection gate G. Moreover, UVLO is a constant-voltage fail safe circuit, and is reference voltage VREF. When it falls to predetermined abnormal voltage, it is a transistor Q1. It is made to operate and is Capacitor CS. It is made to discharge, and while stopping actuation of the PWM comparator PWM etc., an inhibiting signal OFF is given to the output selection gate G. Q2 It is a transistor for an output and is a transistor 21. The chopping voltage signal of the level which flowed for the period which has flowed and followed the electrical potential difference of DC power supply 1 is outputted.

[0006]

The inverter circuit 3 consists of well-known resonance mold push pull multivibrators. Namely, primary winding 311 which has center tap 311c Secondary winding 312 And tertiary winding 313 It consists of the transformer 31 which it had, transistors 32 and 33 of an NPN mold, resistors 34 and 35, and capacitors 36 and 37. Primary winding 311 A capacitor 36 is connected to juxtaposition and it is this primary winding 311. They are the collector of a transistor 32, and a primary winding 311 to an end side. The collector of a transistor 33 is connected to the other end side, respectively. Furthermore, while each emitter of transistors 32 and 33 is grounded, the base of a transistor 32 is a tertiary winding 313. The base of an end side and a transistor 33 is a tertiary winding 313. It connects with the other end side, respectively.

Furthermore, primary winding 311 Center tap 311c is connected to the base of a transistor 33 through the base of a transistor 32, and a resistor 35 through the resistor 34, respectively while connecting with the other end side of a choke coil 23. Moreover, secondary winding 312 An end is connected to the end of a cold cathode tube 5 through a capacitor 37, and the other end is grounded.

[0007]

resistance RS for load current detection to which the modulated light circuit 4 was connected with the other end of a cold cathode tube 5 between touch-down this resistance RS Diode D0 which rectifies the detected load current detection electrical potential difference VS 2 capacitor Co for smooth The partial pressure resistance R1 which pressures partially the rectified electrical potential difference Va2 for load current control, and R2 Resistance RS for load current detection Fixed resistance R0 by which parallel connection was carried out It consisted of variable resistance VR for modulated light, and the electrical potential difference (minute electrical potential difference Vi2) of the adjusted partial pressure point is given to - terminal of error amplifier ER.AMP.

[0008]

When DC power supply 1 are turned on in the configuration of above-mentioned drawing 2, a transistor 21 and a choke coil 23 are minded, and it is the primary winding 311 of a transformer 31. An electrical potential difference is impressed and any they are turns on previously by difference of the amplification factor of transistors 32 and 33. For example, a transistor 32 turns on and it is a tertiary winding 313 by the current. The electrical potential difference of the direction which promotes the ON state of a transistor 32 is produced, and a transistor 32 carries out Fluon. A "on" period is decided from resonance conditions with the inductance of capacitors 36 and 37 and a transformer 31. At the time of the polarity reversals of a resonance wave, a transistor 33 is turned on by the transistor 32 off, and an oscillation continues. Thereby, it is a secondary winding 312. Alternating voltage occurs and a cold cathode tube 5 is turned on. Moreover, current Io which flows to a cold cathode tube 5 A value is detected by the resistance RS for current detection, variable resistance VR, etc. as a load current detection electrical potential difference Vs2, and the rectified electrical potential difference Va2 for load current control is resistance R1 and R2. A partial pressure is carried out and it is outputted as a part electrical potential

difference Vi2. The part electrical potential difference Vi2 is an electrical potential difference VREF by error amplifier ER.AMP. It is compared, the output of the PWM comparator PWM is adjusted so that this each electrical potential difference may become equal mutually, and it is made to correspond to this output and the output of a transistor 21 is adjusted. Here, if the resistance of the variable resistor VR for modulated light is adjusted, the load current detection electrical potential difference Vs2 will be adjusted, the output of a transistor 21 will be adjusted, and, therefore, the brightness of a cold cathode tube 5 will be adjusted.

[0009]

[Problem(s) to be Solved by the Device]

However, since there is a trouble that the switching power supply circuit currently used as the above-mentioned cold cathode tube lighting device is having the oscillator section which generates a sawtooth wave etc., and is expensive, and the whole equipment carries out a cost rise and the synchronization with the frequency of a sawtooth wave and the oscillation frequency of an inverter circuit was not obtained, it might be generated and neither a beat nor the oscillation of the stable control might be completed.

[0010]

The purpose of this design is to offer the cold cathode tube lighting device from which the brightness control by which was easy to constitute and it was stabilized was obtained.

[0011]

[Means for Solving the Problem]

In order that this design may attain the above-mentioned purpose, it has the DC-DC conversion circuit which carries out chopping control of the DC-power-supply electrical potential difference by the switching element. In the cold cathode tube lighting device which carries out DC-AC conversion of the output voltage of this DC-DC conversion circuit, and drives a cold cathode tube A load current detection means to output the load current detection electrical potential difference which detected the load current of a cold cathode tube and is proportional to this load current, The 1st comparator which can adjust with a modulated light means, compares with said load current detection electrical potential difference the load current reference value which it comes to set up as comparison reference voltage to said load current detection electrical potential difference, and outputs a mutual deflection signal, An electrical-potential-difference detection means to output the electrical-potential-difference detection electrical potential difference which detected the output voltage of said DC-DC conversion circuit, and is proportional to this output voltage, It had the 2nd comparator which is made to superimpose a predetermined electrical potential difference on the output signal of said 1st comparator, compares with said electrical-potential-difference detection electrical potential difference the load electrical-potential-difference reference value which it comes to generate as comparison reference voltage to said electrical-potential-difference detection electrical potential difference, and outputs a mutual deflection signal to said switching element as a negative-feedback-control signal.

[0012]

[Function]

According to this design, the 1st comparator compares a load current reference value with a load current detection electrical potential difference, and outputs a mutual deflection signal, and the 2nd comparator compares the load electrical-potential-difference reference value and electrical-potential-difference detection electrical potential difference which made the predetermined electrical potential difference superimpose on the output signal of this 1st comparator, and outputs a mutual deflection signal to said switching element as a negative-feedback-control signal. Therefore, it is controlled by the electrical-potential-difference detection electrical potential difference in agreement with a load electrical-potential-difference reference value, and a load current detection electrical potential difference is controlled in agreement with a load current reference value.

[0013]

[Example]

Drawing 1 is the circuit diagram showing the example of 1 configuration of the cold cathode tube lighting device of this design. In this drawing, the same sign is attached and shown in a part equivalent

to drawing 2, and a below different part is explained.

[0014]

6 is a DC-DC conversion circuit and consists of the same transistor 21, diode 22, a choke coil 23, and dual comparator 25 grade that is marketed by the part number MB47082 and carries out switching control of the transistor 21 also in drawing 2.

[0015]

The part electrical potential difference V_{i1} of the load current detection electrical potential difference $V_S 1$ which carries out the postscript of the dual comparator 25, variable resistance $VR 1$ for modulated light Adjusted load current reference value $VR 1$ st comparator $CP 1$ which compares and outputs the analog signal by mutual deflection this -- 1st comparator $CP 1$ With the load electrical-potential-difference reference value V_{v1} which was made to superimpose a predetermined electrical potential difference on an output signal, and was generated Electrical-potential-difference detection electrical potential difference VF proportional to the output voltage of the DC-DC conversion circuit 2 2nd comparator $CP 2$ which compares and outputs the digital signal by mutual deflection to a transistor 21 as a negative-feedback-control signal It becomes. Drawing 3 is the wave form chart of each part of the dual comparator 25 of operation.

[0016]

if 7 is a current detector and it can set to drawing 2 -- same resistance RS for load current detection this resistance RS Diode $D0$ which rectifies the detected load current detection electrical potential difference $V_S 1$ Capacitor Co for smooth The partial pressure resistance $R1$ which pressures partially the rectified electrical potential difference V_{a1} , and generates the load current detection electrical potential difference V_{i1} for comparison control, and $R2$ Capacitor $C2$ which cuts the noise of an electrical potential difference V_{i1} It becomes and is the 1st comparator $CP 1$ about an electrical potential difference V_{i1} . - terminal is given.

[0017]

8 is the partial pressure resistance $R3$ which is a modulated light circuit and pressures partially the constant voltage by zener diode ZD , and $R4$. Variable resistance $VR 1$ for modulated light which adjusts the division ratio It is a comparator $CP 1$ about the load current reference value (minute electrical-potential-difference VR) by the division ratio become and adjusted. + terminal is given. This part electrical potential difference VR Current I_o of a cold cathode tube 5 It is set up as comparison reference voltage to the load current detection electrical potential difference V_{i1} in order to make it correspond to modulated light assignment. $R5$ and $C3$ Comparator $CP 1$ The resistance and the capacitor which change an output into an analog signal, and $C4$ It is the capacitor which carries out smooth [of this output].

[0018]

$R5$ and $R6$ Electrical-potential-difference detection electrical potential difference VF which is partial pressure resistance for output voltage detection of the DC-DC conversion circuit 6, and is proportional to the output voltage of a circuit 6 2nd comparator $CP 2$ + terminal is given. $C5$ Electrical potential difference VF It is the capacitor which cuts a noise. The output voltage and the electrical potential difference VF of a circuit 6 The full-wave-rectification wave of the resonance decided by the inductance of capacitors 36 and 37 and a transformer 31 is made.

[0019]

Resistance $R7$ 1st comparator $CP 1$ It is the 2nd comparator $CP 2$ about the load electrical-potential-difference reference value (electrical potential difference V_{v1}) on which it is the resistance on which an output signal and the constant voltage by zener diode ZD are made to superimpose with a predetermined ratio, and was superimposed. - terminal is given. This electrical potential difference V_{v1} is the current I_o of applied voltage and a cold cathode tube 5 over an inverter circuit 3. It is the electrical-potential-difference detection electrical potential difference VF in order to make it correspond to modulated light assignment. It is set up as receiving comparison reference voltage. 2nd comparator $CP 2$ Electrical potential difference VF The digital signal by mutual deflection with an electrical potential difference V_{v1} is outputted to a transistor 21 as a negative-feedback-control signal.

[0020]

Actuation of the cold cathode tube lighting device of the above drawing 1 is explained. ON of DC power supply 1 turns on a cold cathode tube 5 similarly in the configuration of drawing 2. Current I_o which flows to a cold cathode tube 5 A value is detected as a load current detection electrical potential difference V_{s1}, a partial pressure is carried out, and it is the 1st comparator CP 1 as a load current detection electrical potential difference V_{i1} for comparison control. It is outputted. This electrical potential difference V_{i1} is a comparator CP 1. Electrical potential difference V_R It is a comparator CP 1 so that it may be compared and this each electrical potential difference may become equal mutually. An output is adjusted. This output is superimposed with the constant voltage by zener diode ZD, and serves as an electrical potential difference V_{v1}, and it is the 2nd comparator CP 2. It is outputted to - terminal. This electrical potential difference V_{v1} is a comparator CP 2. Electrical-potential-difference detection electrical potential difference V_F It is a comparator CP 1 so that it may be compared and this each electrical potential difference may become equal mutually. An output is adjusted and it is outputted to a transistor 21. A transistor 21 is a comparator CP 2. It flows, when an output is L level, when it is H level, it is un-flowing, and they are the current detection electrical potential difference V_{i1} and the electrical-potential-difference detection electrical potential difference V_F. Negative feedback is carried out and it is controlled. It is the variable resistance V_R 1 for modulated light here. If it adjusts, it is an electrical potential difference V_R. It is adjusted, the output of a transistor 21 is adjusted and, therefore, the brightness of a cold cathode tube 5 is adjusted.

[0021]

[Effect of the Device]

As explained above, according to this design, it has the DC-DC conversion circuit which carries out chopping control of the DC-power-supply electrical potential difference by the switching element. In the cold cathode tube lighting device which carries out DC-AC conversion of the output voltage of this DC-DC conversion circuit, and drives a cold cathode tube By the 1st comparator, the load current detection electrical potential difference and load current reference value of a cold cathode tube are compared, and a mutual deflection signal is outputted. By and the 2nd comparator Since the electrical-potential-difference detection electrical potential difference of the output voltage of a DC-DC conversion circuit is compared with the load electrical-potential-difference reference value which made the predetermined electrical potential difference superimpose on the output signal of the 1st comparator and it was made to output a mutual deflection signal to a switching element as a negative-feedback-control signal a configuration -- the **** lighting device in which the brightness control which simplified and was stabilized in low cost is possible can be offered.

[Translation done.]

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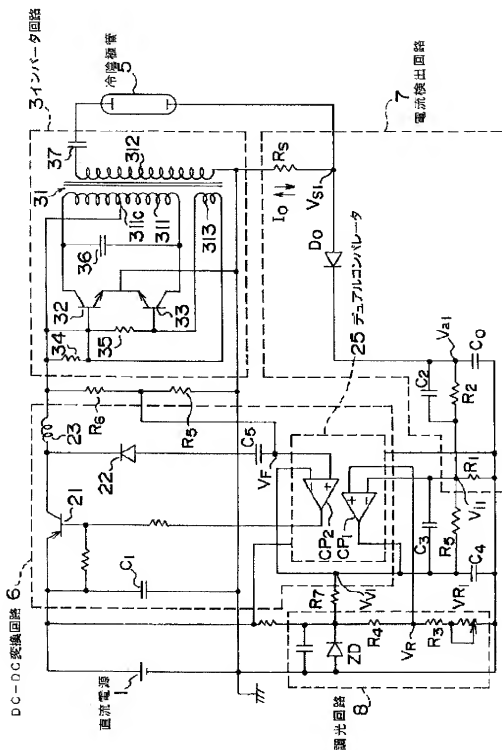
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DRAWINGS

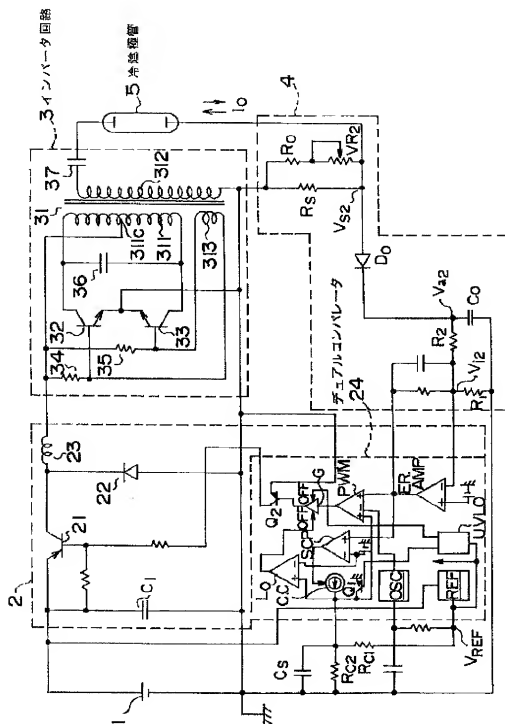
[Drawing 3]



[Drawing 1]



[Drawing 2]



[Translation done.]